Abstract

We present the results of a search for high redshift galaxies in the North Ecliptic Pole (NEP) field using a multi-wavelength data set comprising of optical, mid-infrared data from the AKARI satellite, submillimetre data at 250, 350, 500 µm from the Herschel-SPIRE instrument and at 850 µm from the SCUBA-2 instrument on the JCMT.

We use two techniques: an 850 µm detection from SCUBA-2 and no SPIRE detection (250–500 µm) finding 36 high-z candidates, together with another submm technique: SPIRE colour-colour diagrams and 500 µm rises to select an additional 286 high-z candidates. We perform Spectral Energy Distribution (SED) fitting with our band-merged catalogue and calculate the photometric redshifts, Star Formation Rate (SFR) and evaluate their position in the Main Sequence (MS) by the different models and Star formation Histories (SFH) assumed.

North Ecliptic Pole

The data used are: SCUBA-2 data at 850 µm [1] and from SPIRE at 250µm, 350µm and 500µm [2] in the NEP, which has been observed by several space telescopes and made unique by the contiguous wavelength coverage of the AKARI data. We cross-correlate the SCUBA-2 data with optical-NIR data [3] using a search radius of 5′ in the NEP deep field, whereas in the Wide field the SPIRE catalogue is matched with the optical-NIR data [4] using 7′ search radius instead. Moreover, we incorporate unpublished SUBARU optical data from [5].

Selection of high redshift candidates

- SCUBA-2 maps: 36 high-z candidates
- FIR colour diagrams: 286 high-z candidates

Figure 1: The figure shows the SCUBA-2 map (0.074′) and the Herschel map (0.06′), which have been used to produce the highest candidates catalogue.

Conclusions

- 322 high-z candidates (z > 1.5) are selected, 20 of them with zphot > 4. The average redshift for the sources with more than 5 photometric detections (300 sources) by the SCUBA-2 maps and [6] model and delayed SFH and 324M⊙/yr < SFR < 586M⊙/yr by [7] model and SFH delayed with a starburst.
- At least 8% lie above the MS depending on the SFH model assumed.

Future work

Spitzer and 0.5 μm SED photometry of distant emitters will be the subject of further study with future sensitive broad-band spectroscopy observations at millimeter wavelengths.

References


Figure 2: Example of one of the 36 higher candidates selected by the maps technique. There is a detection in SCUBA-2 map but not in the SPIRE catalogue, however there is a source in the SPIRE maps and we measure the flux directly from the map when the F60um > 10 mJy and there is a detection in another band.

Figure 3: Colour-colour diagram of the SPIRE bands 250/350/500 µm ratio against 500/350/500 µm ratio. It shows 266 high-z candidates selected by [6] and 41 500 µm candidates (23 of them included in the previous criterion). All in all, we select 286 higher candidates that lie in the expected area of the diagram with the redshift in the bar axis.

Figure 4: Example of 2 SEDs fitting by using [6] model. (Left) SFR at zphot = 6.3 (Highz) model is 4.4 which has not been considered in the redshift average, but is a good example of higher candidate.

Figure 5: The figure shows the highest-z source by using [7] model at zphot = 5.6.

Figure 6: SFR against M, with the z represented in the bar. The criterion 2 (SCUBA-2 maps method) find similar redshift and with similar SFR, demonstrating that the SCUBA-2 maps method can be used to find high-z sources. 8% of the sources lie above the MS where we find better results by using a delayed SFH which includes a starburst in the SED fitting.

Figure 7: SFR against M, with the z represented in the bar. The criterion 2 (SCUBA-2 maps method) find similar redshift and with similar SFR, demonstrating that the SCUBA-2 maps method can be used to find high-z sources. 8% of the sources lie above the MS.